REMOVING CO2 FROM THE ATMOSPHERE

For the average Central European citizen, the temperatures of the Libyan desert are probably quite hard to cope with. However, these are the climatic conditions that, according to the Potsdam Institute for Climate Impact Research (PIK), Central Europeans will face in the year 2300. By then, climate researcher Hans Joachim Schellnhuber, director of the PIK, expects temperatures to have increased by 10 degrees over the pre-industrial average.

To avoid the unpredictable consequences that would follow, politicians agreed to try to limit the temperature increase to two degrees Celsius. This agreement was signed in Copenhagen in 2009. But to achieve this goal, greenhouse gas emissions have to be cut back drastically.

Reaching a balance

Still, the Intergovernmental Panel on Climate Change (IPCC) warns that trying to reduce emissions won't be enough and that in the second half of the century, another step will have to be taken: Removing carbon dioxide from the atmosphere and creating so-called 'negative emissions'.

The mix of greenhouse gas emitted by humans comprises mainly of carbon dioxide (CO2) (65 percent) methane (16 percent) and nitrous oxide (six percent). According to the IPCC, the emission and removal of CO2 has to reach a balance between 2055 and 2070. At this time, a tipping point shall be reached, after which more CO2 will be removed from the atmosphere than emitted. Scientists plan a similar scenario for methane and nitrous oxide – their emission and removal must be balanced by between 2080 and 2100.

Using CO2 as a raw material

There are various ways in which experts propose to remove CO2. According to scientists, about one percent of the CO2 emissions can be used as raw material, rather than being emitted into the atmosphere and some pilot projects already exist.

Car manufacturer Audi uses CO2 to create so-called ‘e-gas’, an alternative to regular fuel. CO2 is reacted with hydrogen to produce synthetic methane, or ‘Audi e-gas’. Methane is considered a greenhouse gas, but as the production of synthetic methane removes CO2 from the atmosphere, this e-gas is seen as an eco-friendly way of producing fuel.

CO2 is also being used in the chemical industry. Chemical company Bayer Material Science uses CO2 from coal-fired power plants for the production of plastic polyurethane, which is used to make the foam for mattresses.

Storing CO2

Another way of removing CO2 from the atmosphere is a process called Carbon Capture and Storage (CCS). Compressed CO2, usually waste from power plants or industry, is stored deep within the earth. Natural geological foundations, depleted oil or gas bearings can serve as storage sites. Still, storing CO2 permanently to mitigate emissions is a relatively new concept.

Norwegian oil company Statoil is a pioneer in this field. Kristof Hofer, a carbon capture storage expert at Statoil, says that in order for the technology to be used globally, the price of CO2 should not be lower than 40 to 50 euros per ton. “We need a high and stable price – that’s the main requirement,” he says.

One potential of the CCS technology is to capture emissions at power plants. Coal power plants usually emit CO2 into the atmosphere. When making use of the CCS process, instead of being released CO2 would be compressed and stored in the ground. However, this procedure increases the costs of the power plant drastically. This means the technology could not compete with renewable energy.

Nevertheless, IPCC-author and CCS-expert Manfred Fischedick recommends developing the technology further. ”One day we might have to retrofit existing plants with new technology to combat CO2 emissions,” he tells DW.

As with power plants, CCS could also be used at biogas plants. Plants use CO2 to grow, and store it as carbon. As plants are burned in biogas plants, the CO2 they captured is released into the atmosphere. But when using CCS, instead of releasing the CO2 into the atmosphere, it is put into the ground. Researchers at PIK see potential in this technology, but say it won't be enough to solve the CO2 issue.

Binding CO2 in soil

Other methods of removing CO2 from the atmosphere include imitating natural processes, for example, through reforestation. Just like any other plant, trees capture CO2 and store it as carbon. This means that replanting trees will remove CO2 from the atmosphere.

Another natural process is the formation of humus – organic matter in soil. Created from dead carbon-storing plants, humus has the ability to store carbon.

Humus formation is a slow natural process, and one that can be accelerated and enhanced through a process called hydrothermal carbonization. During this process, plant residues and biowaste are processed using pressure and high temperatures. The end product is called 'hydrochar', which is rich in stable organic carbon, and can be used as soil amendment.

Hans-Josef Fell, a member of Germany's Green Party, sees great potential in this method. "Soil becomes more fertile and we can revegetate dry areas," says Fell. A couple of pilot projects already exist.

Fell promotes research and development in this sector. He sees the possibility to remove 200 gigatons of CO2 from the atmosphere within 30 years. "It would take about eight million hydrothermal carbonization plants in the larger industrial style," he says. "Within 30 years, we could then remove this amount of CO2 from the atmosphere and safely deposit it in the upper soil layers."

The German Institute for Economic Research (DIW) has also done research with hydrochar and sees its potential for saving the climate. However, research is still in the fledgling stages.

Still, despite these times of great innovative research, experts agree that the best strategy to stop global warming is not to remove CO2 from the atmosphere, but to avoid putting it out there in the first place. And they agree that using one of the new technologies won't be enough. There isn't a single silver bullet that will solve the problem.

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